REMARKS

Applicant asserts that the office action of August 15, 2006 should not be final. The MPEP states that "[u]nder present practice, second or any subsequent actions on the merits shall be final, except where the examiner introduces a new ground of rejection that is neither necessitated by applicant's amendment of the claims nor based on information submitted in an information disclosure statement filed during the period set forth in 37 CFR 1.97(c) with the fee set forth in 37 CFR 1.17(p)." (See Manual of Patent Examining Procedure, 706.07(a) Final Rejection, When Proper on Second Action [R-3]). Applicant requests that the Examiner acknowledge that the August 15, 2006 office action should not be considered final.

Claims 4, 8, 19 and 23 stand objected to because of improper Markush language. While Applicant disagrees with the basis of the objection, claims 4, 8, 19 and 23 have been amended as suggested. Reconsideration and withdrawal of this objection is requested.

Claims 30, 31 and 32 stand objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. The claims have been amended. Reconsideration and withdrawal of this objection is requested.

Claims 1-5 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Mathias et al. (US 6,824,909). Although stated separately later in the office action, claims 29-32 stand rejected on the same basis.

Mathias et al (US 6,824,909) discloses water adsorbent particles embedded in a proton exchange membrane of a fuel cell. (Mathias, col. 1, lines 27-30; col. 2, lines 7-13). A hydrogen oxidation catalyst is supported on the water adsorbent material in order to catalyze the reaction of hydrogen and oxygen that are crossing through the membrane. (Mathias, col. 2, lines 13-16). This reaction forms water that serves to irrigate the water adsorbent particles provided within the membrane. (Mathias, col. 2, lines 16-18; col. 3, lines 45-47). "Furthermore, including an

oxidation catalyst 14 in the membrane 10 will shut down one of the well known decay mechanisms in these kinds of fuel cells involving the reaction of cross-over oxygen on the anode to form peroxide which subsequently attacks and degrades the polymer membrane backbone." (Mathias, col. 3, lines 47-52). "Preferably, the water adsorbing particles 12 are smaller than the membrane thickness so that reaction gasses do not leak from the anode to cathode compartment along a string of particles." (Mathias, col. 3, lines 29-32). In one design, the water adsorbent particles are isolated to a central layer to ensure that gas crossover through the membrane structure is held to an acceptable level. (Mathias, col. 3, lines 54-61).

First, Applicant would like to point out a misstatement made by the examiner at page 3, about lines 16-18, where it is stated that "[a]s the hydrogen and oxygen (via carry-over) passes through the proton exchange membrane traveling to the cathode, the recombination catalyst in the membrane causes the formation of water (col. 2, line 13-20). However, in a PEM fuel cell, hydrogen gas is the anode reactant and oxygen gas is the cathode reactant. (Mathias, col. 1, lines 41-42). The concept of reactant cross-over refers to either the hydrogen or oxygen crossing through the membrane. Accordingly, small amounts of hydrogen gas can enter the membrane from the anode electrode and cross toward the cathode electrode. Similarly, small amounts of oxygen gas can enter the membrane from the cathode electrode and cross toward the anode electrode. If either of the reactant gases permeates all the way to the opposing electrode, then there is said to be cross-over of that gas. The cross-over of reactants in a fuel cell, whether hydrogen cross-over to the cathode or oxygen cross-over to the anode, are undesirable. Reactant gas cross-over reduces cell potential, represents a loss of reactants, and (as pointed out by Mathias) can degrade the membrane at the anode.

While reactant gas cross-over to the opposing electrode is clearly a bad thing, Mathias teaches a membrane structure that takes advantage of reactant gases that permeate into the central portion of the membrane. In fact, even Mathias does not want to encourage cross-over of reactant gases and takes steps to ensure that gas crossover through the membrane structure is held to an acceptable level. (Mathias, col. 3, lines 29-31; col. 4, lines 54-61). Mathias teaches that "[t]he hydrogen oxidation catalyst 14 within the membrane will catalyze the reaction of hydrogen

and oxygen that are crossing through the membrane 10." (Mathias, col. 3, lines 42-45). The membrane structure proposed by Mathias is taught to keep the membrane wet, but is also taught to prevent damaging cross-over reactions by consuming the crossing gases before they can reach the opposing electrode.

Applicant asserts that one having ordinary skill in the art having knowledge of Mathias would not be led to dispose a hydrogen oxidation catalyst in the hydrogen or oxidation distribution system, because Mathias has already provided a mechanism that allegedly prevents gas cross-over.

However, it is important to understand that there are significant limitations to Mathias' membrane. First, Mathias' desired water-producing reaction will only occur if the hydrogen gas and oxygen gas are present in stoichiometric ratios. If one or the other gas crosses through the membrane faster than the stoichiometric ratio, then that gas will not be fully reacted out and may cross-over into the distribution system of the other gas. Furthermore, if the oxidation catalyst disposed on the absorbent particle becomes flooded or saturated with water, then the catalytic reaction cannot take place at all. Accordingly, both gases might continue to cross-over into the other gas distribution system.

By contrast, the presently claimed invention is directed to the prevention of explosive concentrations of hydrogen and oxygen gases in either the hydrogen distribution system or the oxygen distribution system. This objective cannot be accomplished by disposing a catalyst in the membrane (Mathias) or by a catalytic electrode disposed on the surface of the membrane. Both of these regions are subject to water flooding and may allow a cross-over gas to enter the distribution system and build up to explosive concentrations. Furthermore, even in the absence of flooding these catalysts, these catalysts could not deter gases leaking through pin holes or otherwise from one gas distribution system to the other. The claimed invention takes the novel approach of disposing a hydrogen-oxygen recombination catalyst in the hydrogen distribution system, the oxygen distribution system, or a combination thereof. These regions are less likely to flood and properly distributed to contact a cross-over gas as it diffuses and

circulated throughout the distribution system of the other gas.

The Examiner has asserted that "[i]t would have been obvious to one having ordinary skill in the art at the time of the invention to dispose a recombination catalyst in the hydrogen or oxygen distribution system to produce water in the cell." (Final Office Action, page 3, lines 19-21). However, as pointed out above, it is not desirable to produce water in the cell in this manner. First, this amount to cross-over that will bring on the aforementioned detrimental effects. Second, liquid water is not desirable in this portion of the cell. Mathias himself points out that "if liquid water remains in the fuel cell at the cathode, oxygen is unable to penetrate the water remaining and reach the cathode catalyst, thereby also reducing fuel cell performance." (Mathias, col. 1, lines 60-65). In fact, liquid water can cover catalysts on either electrode and prevent reactant gases from reaching the catalysts. Mathias is focused on membrane hydration, whereas the present invention is focused on the prevention of explosive concentrations of hydrogen and oxygen gases.

Accordingly, Applicant asserts that Mathias does not teach, show or suggest "a hydrogen-oxygen recombination catalyst disposed in the hydrogen distribution system, the oxygen distribution system, or a combination thereof" as set out in claim 1. In fact, Mathias does not provide a suggestion to so modify his cell, and affirmatively teaches away from any measure that would humidifying a membrane with liquid water supplied via the electrode. Claims 2-5 and 29-32 ultimately depend from claim 1. Reconsideration and withdrawal of the rejection is requested.

Claims 6-12 and 18-23 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Mathis as applied to claim 1 above, and further in view of Shimamune (US 2004/0247978). Applicant asserts that the present claims ultimately depend from claim 1. Having addressed the rejection of claim 1, the present claims are patentable for at least the same reasons. Applicant also reasserts the comments above regarding Mathias, and asserts that Shimamune does not make up for the shortcomings of the Mathias reference. Furthermore, the rejection does not state any motivation to combine the references. Reconsideration and withdrawal of the rejection is requested.

Claims 10, 11, 14, 15, 17, 21, 22, 25, 26 and 28 stand alternatively unpatentable as being product-by-process claims. The Examiner's comments appear directed to the weight given to the claims, rather than the claims being in improper form per se. However, the stated claims each ultimately depend from claim 1 and, therefore, are patentable for at least the same reasons. Reconsideration and withdrawal of the rejection is requested.

Claims 13-17 and 24-28 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Mathias as applied to claim 1 above, and further in view of Cisar (US 6,602,631). Cisar is cited for its disclosure of methods for bonding subassemblies and does not address or make up for the aforementioned shortcomings of the Mathias reference. Reconsideration and withdrawal of the rejection is requested.

In the event there are additional charges in connection with the filing of this Response, the Commissioner is hereby authorized to charge the Deposit Account No. 50-0714/LYNN-0165 of the firm of the below-signed attorney in the amount of any necessary fee.

Respectfully submitted,

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